CLAIMS

1. A method of manufacturing a semiconductor device comprising a first substrate and a semiconductor thin film adhered onto a surface of said first substrate, said method comprising the steps of:

forming a separation layer on a second substrate;

forming said semiconductor thin film including all or part of semiconductor elements on said separation layer;

forming a protection layer on said semiconductor thin film such that said protection layer covers part of said semiconductor thin film;

forming a plurality of etching grooves by etching a region of said semiconductor thin film, which is not covered by said protection layer, so that said etching grooves divide said semiconductor thin film into a plurality of discrete semiconductor thin films, said etching groove reaching said separation layer;

etching said separation layer to make said discrete semiconductor thin films separatable from said second substrate;

adhering said discrete semiconductor thin films onto said surface of said first substrate; and

removing said protection layer, wherein said protection layer is made of a material which has etching resistance against etchants used in said steps of forming said etching grooves and etching said separation layer.

2. The method of manufacturing a semiconductor device according to claim 1, which further comprises the step of forming a dielectric film on a predetermined region of said semiconductor thin film, wherein said protection layer is formed on said dielectric film.

3. The method of manufacturing a semiconductor device according to claim 1, which further comprises the step of forming a passivation film between said semiconductor thin film and said protection layer, wherein both of said protection layer and passivation film are made of a material which has etching resistance against said etchants used in said steps of forming said etching grooves and etching said separation layer.

4. The method of manufacturing a semiconductor device according to claim 2, which further comprises the step of forming a passivation film between said dielectric film and said protection layer, wherein both of said protection layer and passivation film are made of a material which has etching resistance against said etchants used in said steps of forming said etching grooves and etching said separation layer.

5. The method of manufacturing a semiconductor device according to claim 1, wherein said first substrate contains any one of material selected from amorphous silicon, monocrystal silicon, polycrystal silicon, compound semiconductor, organic semiconductor, and an insulating material.

6. The method of manufacturing a semiconductor device according to claim 1, wherein said first substrate is a silicon substrate comprising semiconductor circuits.

7. The method of manufacturing a semiconductor device according to claim 1, wherein said second substrate includes, as an uppermost layer, an etching-stopping layer made of a material which has etching resistance against said etchant used in said step of etching said separation layer.

8. The method of manufacturing a semiconductor device according to claim 1, wherein said semiconductor

thin film is composed of a compound semiconductor epitaxial layer.

9. The method of manufacturing a semiconductor device according to claim 1, wherein said semiconductor elements are any of light emitting elements, photo detectors, Hall elements, and piezoelectric elements.

10. The method of manufacturing a semiconductor device according to claim 2, wherein said dielectric film is made of any of silicon oxide, silicon nitride, aluminum oxide, and aluminum nitride.

11. The method of manufacturing a semiconductor device according to claim 3, wherein said passivation film is made of either polyimide or aluminum nitride.

12. The method of manufacturing a semiconductor device according to claim 1, wherein said protection layer is made of an organic material.

13. The method of manufacturing a semiconductor device according to claim 1, which further comprises the step of forming a conductive layer in a region of said first substrate so that said discrete semiconductor thin films are adhered onto said conductive layer.

14. The method of manufacturing a semiconductor device according to claim 1, wherein said etchant used in the step of forming said etching grooves is made of hydrofluoric acid and said etchant used in the step of etching said separation layer is made of phosphoric acid or solution containing citric acid and hydrogen peroxide.

15. The method of manufacturing a semiconductor device according to claim 2, which further comprises the step of forming a plurality of discrete wiring layers by photolithography, wherein said discrete wiring layers are electrically connected to said semiconductor elements of said discrete semiconductor thin films which have been

adhered onto said surface of said first substrate and extend above said dielectric layer.

16. The method of manufacturing a semiconductor device according to claim 4, which further comprises the step of forming a plurality of discrete wiring layers by photolithography, wherein said discrete wiring layers are electrically connected to said semiconductor elements of said discrete semiconductor thin films which have been adhered onto said surface of said first substrate and extend above said passivation film.

17. The method of manufacturing a semiconductor device according to claim 15, wherein said discrete wiring layers are made of any one of or any combination of two or more of layers selected from an Au layer, an Ti/Pt/Au laminated layer, an Au/Zn laminated layer, an Au/Ge laminated layer, a Ni/Au laminated layer, an AuGeNi/Au laminated layer, a Pd layer, a Pd/Au laminated layer, a MgAu laminated layer, an Al layer, an Al/Ni laminated layer, a polysilicon layer, an ITO layer, and a ZnO layer.

18. The method of manufacturing a semiconductor device according to claim 16, wherein said discrete wiring layers are made of any one of or any combination of two or more of layers selected from an Au layer, an Ti/Pt/Au laminated layer, an Au/Zn laminated layer, an Au/Ge laminated layer, a Ni/Au laminated layer, an AuGeNi/Au laminated layer, a Pd layer, a Pd/Au laminated layer, a MgAu laminated layer, an Al layer, an Al/Ni laminated layer, a polysilicon layer, an ITO layer, and a ZnO layer.

19. The method of manufacturing a semiconductor device according to claim 1, wherein said step of forming said etching grooves in said semiconductor thin film uses said protection layer as an etching mask such that a side of said protection layer and a side of said semiconductor

thin film after forming said etching grooves are located at substantially same position.

20. A semiconductor device comprising:

a substrate;

at least one discrete semiconductor film including at least one semiconductor element and adhered onto said a surface of said substrate; and

a dielectric film provided on a predetermined region of said discrete semiconductor thin film, wherein a side of said dielectric film is located inside a side of said discrete semiconductor thin film.

21. A semiconductor device comprising:

a substrate;

at least one discrete semiconductor film including at least one semiconductor element and adhered onto said a surface of said substrate;

a dielectric film provided on a predetermined region of said discrete semiconductor thin film, and

a passivation film covering said dielectric film, wherein a side of said dielectric film is located inside a side of said discrete semiconductor thin film, and a side of said passivation film and said side of said semiconductor thin film are located at substantially same position.

22. A semiconductor device comprising:

a substrate;

at least one discrete semiconductor film including at least one semiconductor element and adhered onto said a surface of said substrate;

a passivation film provided on a predetermined region of said discrete semiconductor thin film, wherein a side of said passivation film and a side of said discrete semiconductor thin film are located at substantially same position.

23. A semiconductor device comprising:

a substrate;

at least one semiconductor thin film adhered onto a first region of said substrate;

at least one semiconductor circuit thin film adhered onto a second region of said substrate;

at least one semiconductor circuit provided in a third region of said substrate;

a set of first metal thin films electrically connecting said semiconductor thin film and said semiconductor circuit thin film; and

a set of second metal thin films electrically connecting said semiconductor circuit thin film and said semiconductor circuit.